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The Status of the Osprey in Tidewater Virginia, 1970-1971

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Abstract: A survey of the Ospreys of Tidewater Virginia was conducted to determine their population size and breeding status. The study area, consisting of approximately 1087 square nautical miles, was subdivided into nine geographical regions, and included parts of the James River, the tidal area extending from Goodwin Island at the mouth of the York River to Dameron Marsh, just south of the Great Wicomico River, and the entire Eastern Shore of Virginia. In 1970, 194 active nests were located and 0.96 young per nest fledged, while in 1971, 309 active nests were located and 0.69 young per nest fledged. The increase in number of active nests from 1970 to 1971 is due primarily to an increase in area surveyed in 1971 and not to an observed population rise. Fledging rate decreased 28% from 1970 to 1971 and is attributed to an increase in the number of eggs failing to hatch. Nestling mortality decreased from 16.1% in 1970 to 10.8% in 1971. Minimal annual rate of decline (calculated) for the Virginia population is 6.1%.

The Osprey (*Pandion haliaetus carolinensis*) has always been a common breeding bird in the Tidewater area of Virginia. Though still common in some areas, many observers have noted a gradual population decline during the past two decades. This decline is paralleled in other populations of Ospreys, especially those in the northeastern United States (Ames and Mersereau 1964; Ames 1966; Spitzer 1970), and by other raptorial and fish-eating birds. Because of these declines and because the many large populations of Ospreys in Tidewater Virginia have never been quantified (except for Tyrrell's [1936] work at Smith's Point, Virginia), a comprehensive study of these populations was begun to determine their size and breeding status. This is a report on the findings of this study during the 1970-71 nesting seasons.

STUDY AREA

The study area (Fig. 1) consists of approximately 1087 square nautical miles and includes most of the Tidewater area and Eastern Shore of

FIGURE 1. Map of study area in Tidewater, Virginia.

Virginia. This region is characterized by its large number of estuarine systems which divide the land into an intricate maze of peninsulas and islands. For purposes of comparison, the study area was subdivided into nine geographical regions. These regions are described below:

1. James River (160 square nautical miles)—extends between Hopewell and Newport News, Virginia, and includes all tributaries except the Chickahominy River.
2. Chickahominy River (29 square nautical miles)—begins one mile from the mouth of the Chickahominy River and ends at Chickahominy Lake.
3. York River (91 square nautical miles)—includes the entire York River.
4. Mobjack Bay (72 square nautical miles)—includes Mobjack Bay and its four tributaries: the Severn River, the Ware River, the North River, and the East River.
5. New Point Comfort (47 square nautical miles)—borders the Chesapeake Bay between the Island of New Point Comfort and Stingray Point and includes the Piankatank River.
6. Rappahannock River (170 square nautical miles)—includes the Rappahannock River and its tributaries from the Tappahannock to its mouth at the Chesapeake Bay.

7. Fleets Bay (42 square nautical miles)—borders the Chesapeake Bay between Windmill Point, at the mouth of the Rappahannock River, and Dameron Marsh, and includes Fleets Bay and Dividing Creek.
8. Eastern Shore Ocean Side (360 square nautical miles)—includes all of the marshes and barrier islands which occur from Fishermans Island (ocean side) to the Virginia-Maryland border.
9. Eastern Shore Bay Side (120 square nautical miles)—borders the Chesapeake Bay between Fishermans Island (bay side) to the Virginia-Maryland border, and includes Watts Island.

The Chickahominy River, the Eastern Shore Bay Side, and parts of Fleets Bay, the York River, the James River, and the Rappahannock River were not studied in 1970. These areas were included in 1971 to give a broader spectrum of population trends.

Common to all of these areas is the harvesting of seafood and the utilization of bordering land for agricultural purposes. Boating, fishing, and hunting are recreational activities which are increasing in all of the study areas. These activities, combined with the reduction of nesting habitat, may be a cause for lowered Osprey density in some areas.

MATERIALS AND METHODS

Population Surveys

In 1970, study areas were visited at least twice. In 1971, visitation of the study areas was correlated directly with the phenology of the species. Therefore, each area was visited from April through early May to determine the number of active nests and to accumulate a sizable sample of data on clutch size, from mid-May through June to determine the outcome of hatching, and from late June through July to collect information on fledging success. Following this scheme, every study area was visited at least three times. Coverage of the area was made by cruising along the coastlines of each area by boat, recording the precise location of each nest site on geological survey maps. In 1971, aerial surveys were made over the James River and both subdivisions of the Eastern Shore.

Terminology

The terminology used in this paper is based on that reported by Postupalsky (1968). The term "active nest" refers to a nest in which eggs were found or, if inaccessible, to a nest where an adult was observed squatting as if incubating. Active nests are of two types: accessible, in which the contents could be examined; and inaccessible, in which the contents could not be examined. However, in inaccessible nests, the presence of young could be ascertained by the behavior of the adults. The term "productive nest" as used in this paper differs slightly from Postupalsky (1968). Here it refers to nests in which one or more eggs hatched, whether or not the young survived to fledge.

Egg Collection

Eggs were collected when they were found to be cracked, dented, pierced, or addled, or when they were known to have been incubated 5 days longer than the normal incubation period of 35-37 days (Spitzer pers. comm.; Kennedy pers. observ.). Data collected on these eggs, which includes eggshell weight and thickness and pollutant residue levels, will be reported on at a later date.

Nesting Platforms

Aluminum poles, 15 ft long and mounted with four 30-inch prongs, were used as artificial nesting platforms for Ospreys (Fig. 2). After choosing a platform location either in an open marsh or in a peninsula of open land, a 3-ft-deep hole was dug and the preconstructed platform was cemented in place. Before installation, nesting material was woven into chicken wire which lined the prongs.

Banding

Size 8, clip-on Fish and Wildlife Service aluminum bands were used with 10 mm plastic wrap-around colorfast bands to mark nestling Ospreys. Seven colors (red, yellow, blue, light green, dark green, black, and white) were chosen for this marking program. Possible combinations using two color bands and the aluminum band, with no more than two bands per leg, were found to number 288. This allowed for a

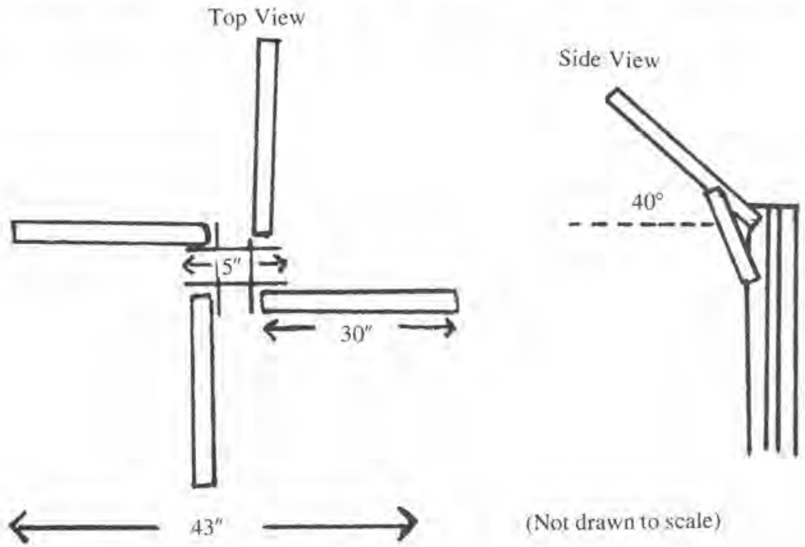

FIGURE 2. Diagram of aluminum nesting platform.

distinct combination for each nestling banded; thus, after fledging, each bird could be individually identified.

RESULTS

During the study period, the earliest arrival date of an Osprey was on 25 February 1971. The majority of birds returned between 8 and 15 March, each year.

Nests

The total number of active nests found during the 2-year study is shown in Table 1. The increase in nests from 1970 to 1971 is quite substantial in the Rappahannock River, York River, Fleets Bay, and in the total for the whole state. However, this increment is due to an increase in area surveyed in these regions during 1971, and not to an observed population rise.

The various types of nest sites used by Ospreys can be classified into two categories: natural, consisting of dead snags, live pines (*Pinus virginiana*, *P. taeda*), bald cypress (*Taxodium distichum*), red cedar (*Juniperus virginiana*), and live hardwood trees (*Quercus virginiana*, *Quercus* sp., *Liriodendron tulipifera*, *Platanus occidentalis*), making up 49% of the total in 1970 and 47.6% in 1971; and man-made, consisting of a myriad of diverse structures from abandoned ships to active docks, making up 51% in 1970 and 52.4% in 1971. The dead snag was the predominant structure used, and was the site of more than one-third of all nests. Channel markers, both lighted (16% for the 2 years) and day (9% average) markers, and duck blinds (12% average), most of which occurred over water, were the most utilized man-made nesting structures.

Eggs

In 1970, though the first egg laid was on 30 March, the major laying period extended from 3-27 April, with an apparent peak on the 19th or 20th. During 1971, the major laying period was longer, extending from 3 April to 1 May. The highest peak for 1971 was reached on 11 April.

Clutch-size data are presented in Table 1. The average clutch size was almost identical for 1970 and 1971, being 2.87 and 2.85, respectively. Within each area, the values fluctuated somewhat more, but the differences were not found to be significant ($P>0.05$, *t*-test). The percentages of two-, three-, and four-egg clutches were, in that order, 25.0 ($n = 13$), 63.5 ($n = 33$), and 11.5 ($n = 6$) for 1970; and 27.5 ($n = 33$), 60.0 ($n = 72$), and 12.5 ($n = 15$) for 1971.

Causes of egg loss are reported in Table 2. Disappearance of eggs between surveys represented the greatest loss (58%) for both 1970 and 1971. The disappearance of these eggs is very likely due to their

TABLE 1. Summary of Virginia Osprey reproduction, 1970–71.

	James River		Chickahominy River		York River		Mobjack Bay		New Point Comfort		Rappahannock River		Fleets Bay		Eastern Shore Ocean		Eastern Shore Bay		Total	
	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71	'70	'71
Active nests	3	6	–	12	11	28	15	17	50	45	57	77	17	29	41	46	–	49	194	309
Average clutch size[a]	ND[b]	2.8	–	ND	2.8	2.9	3.0	2.9	3.0	3.0	2.5	2.9	3.0	2.7	2.7	2.9	–	2.4	2.87	2.85
No. of nests productive	0	0	–	4	3	11	7	6	28	28	40	39	10	13	29	16	–	14	117	131
% of nests productive	0	0	–	33	27	39	47	35	56	62	70	51	59	45	71	35	–	29	60	42
Calculated no. of young produced[c]	0	0	–	6	5	18	14	12	60	56	75	76	20	20	48	27	–	26	222	240
% of eggs producing hatchlings	ND	0	–	ND	16	22	31	25	40	41	53	34	39	25	43	20	–	22	40	27
Average no. of young per productive nest	0	0	–	1.50	1.67	1.67	2.00	2.00	2.14	2.00	1.88	1.94	2.00	1.58	1.65	1.66	–	1.83	1.88	1.84
Average no. of young per active nest	0	0	–	0.50	0.45	0.66	0.93	0.71	1.20	1.24	1.32	0.98	1.18	0.68	1.17	0.58	–	0.52	1.15	0.78
No. fledgings per productive nest	0	0	–	1.25	1.67	1.67	2.00	1.50	1.79	1.86	1.53	1.61	1.30	1.28	1.48	1.54	–	1.83	1.59	1.63
No. fledglings per active nest	0	0	–	0.42	0.45	0.66	0.93	0.53	1.00	1.16	1.08	0.81	0.76	0.57	1.05	0.54	–	0.52	0.96	0.69
Minimal annual rate of decline in %[d]	18.5		12.0		9.2		7.3		1.7		3.9		8.6		6.4		10.4		6.1	

[a] These values represent averages based on nests sampled.
[b] No data.
[c] Average number of young per productive accessible nest per area multiplied by number of productive nests per area.
[d] Calculated using the formula from Henry and White (1969).

TABLE 2. Causes of Osprey egg and young loss 1970–71.

Cause of loss	1970 Eggs	1970 Young	1971 Eggs	1971 Young
Disappeared between surveys	62 (58)[a]	18 (50)	139 (58)	17 (65)
Eggs collected	30 (28)	–	64 (27)	–
Young found dead (unknown cause)	–	8 (22)	–	5 (19)
Eggs found dented, broken, cracked or with pin hole	3 (3)	–	15 (6)	–
Eggs collected for experiment	–	–	21 (8)	–
Predation	9 (8)	–	–	–
Wind	2 (2)	2 (5)	2 (1)	–
Heat	–	–	–	1 (4)
Taken by humans	–	1 (4)	–	–
Sent to Connecticut	–	5 (14)	–	3 (12)
Fell from nest and starved	–	2 (6)	–	–
Total	106 (100)	36 (100)	241 (100)	26 (100)

[a] Numbers in parentheses indicate percent.

breakage; however, the probability of predation cannot be eliminated. Eggs classified as "Eggs Collected" account for a considerable loss (reasons for collection have already been discussed). "Eggs Collected for Experiment" were freshly laid eggs used for an incubation-renesting experiment which is described elsewhere (Kennedy 1972). The number of eggs found dented, broken, cracked, or with small pin holes increased from 3% in 1970 to 6% in 1971. Eggs found dented were reported only in 1971. Predation, probably by humans, accounted for the loss of nine eggs in 1970. Nests blown down by wind accounted for the loss of two eggs in both 1970 and 1971.

Young

The number of young produced per productive nest (Table 1) ranged from 1.50 to 2.14 during the 1970 and 1971 seasons. For both years, the averages for each area were almost identical (differences were not statistically significant, $P>0.05$, *t*-test). The percentages of nests containing one, two, and three young were, respectively: 30.8 ($n = 28$), 50.5 ($n = 46$), and 23.5 ($n = 17$) for 1970; and 39.2 ($n = 40$), 37.3 ($n = 38$), and 23.5 ($n = 24$) for 1971.

Causes for the loss of young are summarized in Table 2. In 1970, a total of 36 young were lost, representing a mortality rate of 16.1%. Fewer young were lost in 1971 (26, at 10.8% mortality). The greatest loss of young (50 and 65%) was their disappearance between surveys. Many young in accessible nests were thought to have been taken by humans, but this form of loss, except in one instance, has not been documented. In both accessible and inaccessible nests, the loss might have been caused by some natural predator as discussed in Reese (1970) and in Ames and Mersereau (1964). Young that died in the nests of unknown causes accounted for the second highest (22 and 19%) loss of young. Eight young were collected from the Rappahannock River area, and sent to Connecticut to maintain the declining population there. Two young were lost when their nest, located on top of a day channel marker, was blown down during a severe windstorm in 1970. Also in 1970, two fledging-age birds were found dead at the base of their nest, apparently having starved to death after falling out of their nest. One 8-day-old bird, suspected of dying from heat exhaustion, was found in its nest in 1971. Heat exhaustion might account for the loss of young that disappeared (in which case the parents might have removed the dead chick from the nest) or that died of unknown causes.

Percentages of eggs producing hatchlings (hatching success) and number of young fledging per active nest are summarized in Table 1. The highest value determined for fledging success was the 1.16 young found at New Point Comfort in 1971. New Point Comfort and the York River were the only areas to have increased production rates from 1970 to 1971, while the remaining areas showed a decrease in rate. The largest decrease can be found in the Eastern Shore Ocean Side, where hatching success and fledging success decreased about 50%. The overall production was down 28% from 1970, though differences between numbers fledging per productive nest and per active nest for 1970 and 1971 were not statistically significant ($P>0.05$, *t*-test). The James River area, for the second straight year, did not produce a single young.

The minimal annual rate of decline for each study area is shown in Table 1. As expected, New Point Comfort has the lowest annual rate of decline, while the James River has the maximum value of 18.5% annual rate of decline. Other areas with apparently severely declining populations are the Chickahominy River (12.0%), the Eastern Shore Bay Side (10.4%), and the York River (9.2%). These percentages are calculated values and are not based on observed population decreases.

Platform Utilization

Of the 20 platforms constructed, 11 were placed in the Eastern Shore Ocean Side study area and 9 were erected in the New Point Comfort area. Six platforms were used for the first nestings by Ospreys. "Frustration nests," which adult birds build after they have lost their eggs or young late in the nesting season, and in which no eggs are laid that season, accounted for four more utilizations.

Banding

In 1970, 114 nestlings were color-banded, while in 1971, the number was increased to 143. Six additional young were banded in 1970, but were not color-banded.

DISCUSSION

The reproductive failure witnessed in the Osprey and other raptor populations throughout North America and Europe is also being experienced by Ospreys in Virginia. The number of young fledged per active nest in the study area declined from 0.96 young per nest in 1970 to 0.69 young per nest in 1971. Earlier fledging data for Virginia (Tyrrell 1936, cited in Postupalsky 1969) indicate that 1.60 young fledged per active nest in 1936. As Henny and Wight (1969) have shown, when shooting is eliminated as a cause of mortality, only 0.95 young fledged can maintain a stable population. This would seem to indicate that the 1970 population was producing enough young to maintain a stable population. However, by including shooting as a factor of mortality, the number of young needed increases from 1.22 to 1.30. At the present fledging rate, Virginia's Osprey population is declining (calculated value, not observed decline) at the rate of 6.1% annually.

The James River study area is of particular concern. No young were produced on this river during the 2 years it was studied. This large river is well suited for the Osprey, providing numerous nesting sites and no apparent lack of food. However, the low numbers of breeding birds found there indicate that this river system has been suffering low reproductive success for a number of years. Though no early population data are available, the population crash in this area might have paralleled that reported in Connecticut by Ames and Mersereau (1964), Ames (1966), and Peterson (1969). The minimum annual rate of decline for the James River population was calculated as 18.5%, and is the highest rate of decline that can be calculated using Henny's and Wight's (1969) equation. However, as indicated by the 30% annual decline actually found in the Connecticut population, the calculated value may be low and misleading.

Other areas fledging low numbers of young include the York River in 1970, with 0.45 young fledged per active nest, and the Bay and Ocean sides of the Eastern Shore in 1971, fledging 0.52 and 0.54, respectively. As noted earlier, the Ocean Side population suffered a 50% decline in the number of young fledged from 1970 to 1971. The low hatching success of the Eastern Shore may be related to the heavy contamination of this area by DDT, which is still used extensively, particularly on the sweet corn crop. The Rappahannock River, though showing a 25% reduction of young fledged in 1971, has the highest fledging rate for any river system in Virginia. The high fledging rate of 1.16 at New Point

Comfort approximated the stability level. For comparison of Virginia population figures with other North American populations see Reese (1970).

Low hatching rate, as a reason for poor reproductive success of Ospreys, has been reported by Ames and Mersereau (1964), Ames (1966), Wiemeyer (1971), and Spitzer (unpubl. data). The hatching rate for the Virginia population in 1971 was 27%, and is thought to have accounted for the reduced fledging rate for that season. Nestling mortality for 1971 was lower (10.8%) than in 1970 (16.1%), and was therefore eliminated as a possible cause for the reduced fledging rate.

The average number of eggs per clutch and the average number of young produced per productive nest have not varied from the information published before 1947 (when pesticides were first widely used) by Tyrrell (1936) and Bent (1937). If some environmental factor such as pesticide contamination is the cause for the failure of production of young in some nests, then it would seem that birds which lay eggs that hatch have either lower body contamination or lower equilibrium levels. Another explanation might be that some birds which can resist high levels of pesticides are subject to selective pressures. In Virginia, the apparent poor hatching success for the James River, York River, and Eastern Shore as opposed to the high hatching success for the New Point Comfort and Rappahannock River areas is thought to be due to the varying levels of environmental pollutants. However, there are no data available at this time to support this suggestion.

The discussion, at this point, raises the following pertinent question. If persistent chlorinated hydrocarbons are the cause for reduced hatching success (Heath et al. 1969) and for thin eggshells (Anderson et al. 1969; Bitman et al. 1970; Peakall 1970), what immediate effect would the discontinued use of these chemicals have on birds of prey? Stickel et al. (1966) and Wesley et al. (1965) have shown that with suspended food dosage of DDT, body levels of this pesticide would decrease in Bald Eagles (*Haliaeetus leucocephalus*) and in domestic fowl. In the case of the eagles, levels would be reduced one-half in 3-5 months. In Scotland, Lockie et al. (1969) and Everett (1971) have reported that with discontinued usage of dieldrin in the mid-1960s, there was a corresponding 50% decrease of dieldrin in the eggs of Golden Eagles (*Aquila chrysaetos*), an increase in shell thickness, and an increase of fledging success from 31% in 1963 to 69% in 1967. After discontinuation of a 20-year program of spraying the salt marshes of eastern Long Island, New York, the reproductive success of the Ospreys of Gardiners Island began to show signs of improvement. In 1966, when the program was stopped, the birds fledged 0.05 young per active nest. Four years later, the fledging rate had increased to 0.66. It would appear, therefore, that discontinued usage of DDT and dieldrin might well result in higher chances for survival in Ospreys as well as in other raptors.

Although man appears inadvertently to have been the major factor in the decline of the Osprey, he has, at the same time, helped the species by providing artificial lakes and reservoirs (Berger and Mueller 1969) which have increased available nesting habitat, and by provision of man-made nesting structures, such as duck blinds (Tyrrell 1936; Reese 1970) and channel markers (Reese 1970).

The utilization of channel markers accounts for 25% of the nesting structures used by Virginia Ospreys. The U.S. Coast Guard, until recently, has destroyed many nests and their contents which were found on channel markers. On lighted markers, the nests were destroyed either because they obstructed the beacon, thus creating a hazard to navigation, or because the nest interfered with the changing of the batteries for the beacons. On day markers, the nests were destroyed when they reduced the legibility or recognition of the structure. Reese (1970), in Maryland, attributed the loss of 35 eggs and six nestlings to the Coast Guard. Because of the high percentage of Ospreys nesting on channel markers in Virginia, the Coast Guard may have been imposing a heavy factor of mortality on this population. However, Mr. Gilbert Fernandez has recently instructed the Chesapeake Bay Coast Guard to inform either him or the College of William and Mary when nests are going to be destroyed, so that experienced persons can accompany them. Two trips were made with the U.S. Coast Guard during this study, and in both cases, the nests could be manipulated in such a way as to prevent their destruction.

Reese (1970) has shown that two-thirds of his population in Talbot County, Maryland, nests on structures occurring over water. This fraction is somewhat higher than that of Virginia, where approximately one-half of the nests occur over water. Though in more recent investigations, Ospreys have been reported nesting over water, this has not always been the case. Tyrrell (1936) found that 93% of 76 nests in Smith's Point, Virginia, were located on land nesting sites. Shifting from land to water nesting structures can be caused by at least two factors: (1) the birds were forced to move out over water because of the destruction of natural sites by man; and (2) the birds, showing a preference for open, well-exposed nest sites, readily move to water sites. I believe that a combination of the two reasons explains the adaptation to water nesting sites. The variety of man-made nesting structures that the Osprey uses demonstrates the partial adaptability of this species to a changing environment.

The purpose of constructing artificial nesting structures for Ospreys is to attract nesting birds to an isolated area and to a structure which is virtually mammalian predator-proof. Ames and Mersereau (1964) and

Peterson (1969) described 21 nesting platforms they constructed on Great Island, in Connecticut. Postupalsky (unpubl. data) described cedar platforms in Michigan, while Valentine (1967) described a very elaborate type of platform, also utilized in Michigan. Reese (1970) has constructed 133 platforms in Maryland, during the period from 1963 to 1969, all of which were made of scrap wood. All of these structures have proven very successful in attracting Ospreys.

The importance of offshore nesting structures cannot be overemphasized. Large-scale programs in Virginia should be undertaken to install artificial nesting platforms along all the river systems. Proper location of these platforms is essential. Postupalsky (unpubl. data) noted lowered utilization of his cedar platforms when they were placed in water near other potential nesting sites. Therefore, it is suggested that erection of platforms should be in open, shallow water, from 50 to 200 yards offshore. These offshore platforms, along with predator-proof aluminum poles already constructed, would provide ideal nesting sites for the birds and would reduce losses of eggs and young to land predators, and to possible destruction of natural sites by wind (Valentine 1967; Reese 1970) and by flooding (Ames and Mersereau 1964; and Reese 1970), and will open up new areas for nesting.

Although the present study reveals a drastic reduction of young fledged from 1970 to 1971 and provides evidence for the decline of Ospreys in Virginia noted by naturalists, it should be stated that long-term population trends cannot be evaluated from the data collected during a 2-year study. It is desirable, therefore, in view of the declining North American Osprey population, to continue the population survey for at least another 2 years in order to ascertain if any definite trends can be discerned.

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